

SECTION 2. SYSTEM DESIGN:

2.1 WATER DISTRIBUTION PRESSURE:

- A minimum residual pressure of 20-psi shall be maintained throughout the water distribution system under any condition.
- Where the pressure at the service tap exceeds 80 psi, the provisions of the Uniform Statewide Building Code shall apply. Pressures may exceed 80-psi for areas where the finish floors are less than 70-feet in elevation.
- Flows required for fire protection shall be in accordance with applicable requirements of the National Fire Protection Agency, Insurance Services Office, State and local agencies, and subject to the approval of the Fire Chief of James City County.
- A water distribution system hydraulic analysis, with fire flow analysis, showing the hydraulic gradient at key points shall be included with plan submittals requiring water main extension of the JCSA water system or as required by JCSA.

2.2 ACCEPTABLE WATER MAIN SIZES: JCSA permits 4, 6, 8, 12, 16, 20 and 24-inch diameter mains as part of its distribution system. Proposed mains, larger than 20-inch in diameter, shall be coordinated with the JCSA Chief Engineer – Water at the conceptual plan stage. The minimum size of pipe where fire protection is to be provided or required shall be eight inches in diameter unless otherwise approved by the Fire Chief and JCSA.

A. Pipes of smaller diameter may be used in the following instances where fire protection is not required, and justification is provided with a hydraulic analysis including the proposed and future domestic and irrigation water uses as follows:

- Six-inch pipe and lesser diameter pipe may be used if 40-psi minimum pressure and flow of three (3) gallons per minute plus irrigation demands per connection can be maintained.
- Four-inch pipe may be used when the run is less than 600-feet but more than 300-feet, and a flow rate of three (3) gallons per minute plus irrigation demands per connection, with a 40-psi minimum pressure can be maintained.
- Two-inch pipe may be used when the run is less than 300-feet, and a minimum pressure of 40-psi can be maintained with a flow rate of three (3) gallons per minute plus irrigation demands.

2.3 ACCEPTABLE WATER SERVICE CONNECTION SIZES: The acceptable water service connection sizes are 3/4, 1, 1-1/2, 2, 4, 6, 8 and 12-inches in diameter. A gate valve shall be installed at the tee for all service connections 4-inches and larger.

2.4 COVER: The minimum depth of cover for water distribution systems and sanitary force mains shall be 36 inches, measured from the top of the pipe to the established finished grade above the pipe. During design, site layout of other infrastructure (i.e. storm sewer, gravity sanitary sewer, etc) shall be considered in minimizing the need to have deep pressure mains.

- 2.5 **EASEMENTS:** Permanent easements of 20-feet width for water mains and services and 20-feet width for sanitary sewer mains and services, minimum, shall be provided on all private property. (Combined water and sanitary sewer easements shall be 30-feet minimum.) For gravity sanitary sewers between 12 and 20-feet deep, the width of easement shall be 30-feet minimum; and for gravity sanitary sewers over 20-feet deep, easements shall be a minimum of 40-feet wide. Additional easement width may be required by JCSA. Prior to considering an easement as permanent, all surface conditions must be restored to original or better condition. The easement shall be stabilized within 30 calendar days of the completion of construction. Easement plats and deeds shall be recorded prior to JCSA site plan approval, except where the easements will be recorded as part of a subdivision plat. Any proposed offsite easements shall be secured by the Developer prior to JCSA plan approval.

JCSA shall not accept nor be responsible for repairing, maintaining, or locating any portion of the water or sanitary systems prior to dedication of the appropriate corresponding utility easement(s) relating to the said development. Existing water and sanitary systems within the said development currently not within an easement shall also have appropriate easements dedicated prior to acceptance of new development water and sanitary systems. JCSA reserves the right to require existing easements to comply with current easement width criteria for development projects (i.e. increase existing easement width from 10-feet to 20-feet).

No building or permanent structures shall be constructed within a JCSA Utility Easement. No trees, shrubs, structures, fences, irrigation mains, invisible pet fences or other obstacles shall be placed within an easement which would render the easement inaccessible by equipment. Shrubs shall be a minimum of 5 feet, and trees a minimum of 10 feet, from the center of water and sanitary sewer pipelines. JCSA will not be responsible for replacement of trees and shrubs placed within the easement.

Water and sanitary sewer easements are exclusive, and shall be designated on the plans and plat as "JCSA Utility Easement," with the width specified, unless otherwise authorized by the JCSA.

The following note shall be added to all plats containing JCSA Utility Easements:

"Easements denoted as "JCSA Utility Easements" are for the exclusive use of the James City Service Authority and the property owner. Other utility service providers desiring to use these easements with the exception of perpendicular utility crossings must obtain authorization for access and use from JCSA and the property owner. Additionally, JCSA shall not be held responsible for any damage to improvements within this easement, from any cause."

Any existing JCSA easement requiring abandonment or extinguishment will require approval by the JCSA Board of Directors. Appropriate materials (plat, deed, exhibits, etc) including fees shall be submitted by the Developer/Engineer for JCSA presentation to the Board of Directors.

- 2.6 **DEAD ENDS AND HIGH POINTS:** Dead ends shall be minimized by looping of all water lines where possible. Where dead-end lines occur, they shall be provided with a fire hydrant,

or permanent blow-off for flushing purposes. The flushing device shall not be directly connected to any sanitary sewer. Approved manual air release devices shall be installed at all system high points. **All devices shall be inspected by JCSA prior to backfilling.** Consideration shall be given to providing a suitable means of conveying flush water to an adequate outfall channel, thus precluding potential erosion problems.

- 2.7 **EXTENSION PROVISIONS:** Provisions shall be made for logical future water and sanitary sewer extensions. Future water main and sanitary force main extensions shall be provided with a gate valve and a minimum of a full joint of pipe beyond the gate valve. This pipe shall be properly restrained, plugged, blocked, pressure tested, and disinfected (water mains only) along with the rest of the piping system. After passing inspection, the gate valve shall be closed. A temporary blow-off assembly shall be installed at the end of all extensions. Gravity sanitary sewer extensions from manholes shall be provided with a 2-foot stub of pipe properly plugged to prevent infiltration. When the gravity sewer is extended, the 2-foot stub shall be removed, and replaced with a full joint of pipe.
- 2.8 **HYDRAULIC ANALYSIS:** A hydraulic analysis is required for all water system design projects requiring an extension of the water distribution system, and/or installation of new fire hydrants and/or as required by JCSA. The hydraulic analysis shall be used to verify flow demands and pressure availability for the proposed project and to justify pipe sizes. The analysis shall also demonstrate the effect the proposed project will have on the existing distribution system. The hydraulic analysis shall include as a minimum the following:
- A. Under peak hour demands (excluding fire demands), the water distribution system shall maintain pressures above 40-psi.
 - B. Under maximum day plus fire demands plus applicable irrigation demands, the water system shall maintain pressures above 20-psi.
 - C. Water system layouts shall be designed to minimize dead ends. Looping water lines is a standard practice to eliminate dead ends.
 - D. Velocity in any pipe line (excluding fire hydrant six-inch runs) shall not exceed 5 fps under any condition.
 - E. Head losses in any pipe line (excluding fire hydrant six-inch runs) shall not exceed 25-feet per 1,000 feet of pipe line.
 - F. Provide a separate hydraulic analysis for each phase of the project to confirm adequate system design.
 - G. The water model calculations must be sealed, signed and dated by a Licensed Professional Engineer, currently licensed by the Commonwealth of Virginia.
 - H. The hydraulic analysis shall be neatly organized and bound. Provide a summary describing the project, the basis of the calculation procedures performed, name and version of the software. The analysis shall be provided in printed form as well as

electronic form. The electronic copy shall include the input data for inclusion in the JCSA system model.

- I. Provide a node map that includes pipe numbers, reservoirs, pumps, junction numbers, contours to check elevations, locations of fire hydrants, and lot locations.
- J. Provide in the model irrigation demands that might be applied to this development. If no irrigation demands are included in the model, then provide justification of how the irrigation will not be allowed for this project. If irrigation demands are included for this development, then describe how the irrigation demands were developed and what mechanisms will be in place to control them. An example of justification might include the homeowner covenant documentation prohibiting outdoor irrigation of all kinds or allowing irrigation under specific circumstances that support the irrigation demand calculations. Provide a written discussion of irrigation demands with the analysis.
- K. Provide a software generated date/time stamp on all water model pages.
- L. Provide in the hydraulic analysis the following:
 - 1. Fire hydrant flow tests for which the model is based and a description of input assumptions such as reservoir data and pump data that simulates the flow test.
 - 2. Listing of all inputs for all pipes, nodes, pumps, reservoirs, etc, used in the model.
 - 3. Include Average Day Demand Analysis.
 - 4. Include Maximum Day Demand Analysis.
 - 5. Include Maximum Day Demand + Fire Flow + any applicable irrigation demands. The water system must maintain 20-psi at all nodes.
 - 6. Include Peak Hour + any proposed irrigation demands. The pressures in the system must be maintained above 40-psi at all nodes.
 - 7. Include a Global Fire Flow Analysis.
 - 8. No pipe velocities shall exceed 5 fps, under any condition
 - 9. No pipe head losses in any pipeline shall exceed 25-feet per 1,000-feet of pipe.
 - 10. Provide separate hydraulic analysis for each phase of the project to confirm adequate system pressures and flows during phase development. Apply the fire flow within the phased area.
 - 11. Pipe reports must include the following information at a minimum:
 - a. Pipe number

- b. Starting Node number and Ending Node number
- c. Status
- d. Pipe diameter (inches)
- e. Pipe length (feet)
- f. C-Factor (C-Factor of 130 is the maximum allowed)
- g. Discharge (gpm)
- h. Velocity (fps)
- i. Head losses (ft)
- j. Minor losses (ft)

12. Junction reports must include the following information at a minimum:

- a. Junction number
- b. Elevation (ft)
- c. Demand (gpm)
- d. Description (description for calculating demand)
- e. Calculated demand (gpm)
- f. Pressure Head (ft)
- g. Residual pressures at all nodes (psi)
- h. Hydraulic Grade Line (ft)

13. Reservoir report must include the following information at a minimum:

- a. Label
- b. Elevation (ft)
- c. Hydraulic Grade Line (ft)
- d. Inflow (gpm)

- e. Outflow (gpm)

14. Pump report must include the following information at a minimum:

- a. Label
- b. Status
- c. Elevation (ft)
- d. All input information
- e. Intake pump grade (ft)
- f. Discharge pump grade (ft)
- g. Discharge (gpm)
- h. Pump head (ft)

2.9 **WATER AND SANITARY SEWER SYSTEM DATA SHEETS:**

A. **Water Data Sheet:** Provide a completed Water Data Sheet with all water system projects. The Water Data Sheet shall be completed as follows:

1. Date: Provide the date the Water Data Sheet was completed. If revisions are necessary, add each revision date. Provide the JCC case number.
2. Provide the following information under General Information:
 - a. Provide the project name: The project name must match the name on the JCC Case Application.
 - b. Provide the project address: Provide the address if available or a description of the location of the project.
 - c. Developer: Provide the firm name of the responsible party for the development.
 - d. Submitted By: Provide the name of the firm submitting this project for review.
 - e. Contact Person: Provide the name of the contact person JCSA may contact to address questions concerning the application.
 - f. Address: Provide the address of the contact person.

- g. Provide the phone and fax numbers and the e-mail address of the contact person for this application.

3. Provide the following information requested under Design Information as follows:

- a. Source of Water: List the source of water for this project (i.e., JCSA Central Water System, Newport News Water Works, or one of the JCSA Independent Water Facilities, or other, etc).
- b. Flow Information: Flow information shall be in accordance with the types of development, units, flow, and flow duration in accordance with Table 2.1. Any deviations from this Table will require supporting documentation and will require VDH approvals.
 - i. Total Flow (GPD): Provide the calculated total GPD based on the project development type.
 - ii. Irrigation Demand (gpm): Provide the irrigation demands that are applicable to this project. If no irrigation demands are included in this project, then no in-ground irrigation systems will be allowed with this project.
 - iii. Average Day Demand (gpm): Provide the calculated average day demand using the values associated with Table 2.1 based on the number of units, flow rate and flow duration for each development type for master planning purposes and residential developments. For site specific site projects, the demand shall be calculated based on the International Plumbing Code (IPC) for fixture counts and flow values. The IPC flow value, which is a peaked demand, shall be divided by a factor of 4 for the Average Day Demand.
 - iv. Maximum Day Demand (gpm): Provide the calculated maximum day demand based on the average day demand with a peaking factor of no less than 1.7. Different peaking factors must be supported with documentation and will be subjected to VDH approvals.
 - v. Peak Hour Demand (gpm): Provide the calculated peak hour demand based on the average day demand with a peaking factor of no less than 4.0. Different peaking factors must be supported with documentation and will be subjected to VDH approvals.
- c. Hydraulic Analysis: Provide the combined volume of the peak hour demand plus the irrigation demand and at what minimum residual pressure as supported by the hydraulic model.

4. Provide the Fire Hydrant(s) Flow Information as follows:
 - a. Provide the actual fire hydrant flow test information and attach a copy to the hydraulic analysis. Information to be provided is the fire hydrant number or address, static pressure (psi), residual pressure (psi), pitot pressure (psi), residual flow (gpm) and the estimated flow at 20-psi and the date the fire hydrant flow test was performed.
 - b. Provide the fire flow volume required for this project as stipulated in Section 2.11. Deviations from the JCSA required fire flow volumes must be approved in writing by the James City County Fire Department and the supporting documentation attached.
 - c. Hydraulic Analysis: Provide the volume (gpm) of the total fire flow plus maximum day demand plus any applicable irrigation demands and the minimum pressure in psi.
 - d. Number of Existing Fire Hydrants: Provide the number of existing fire hydrants used to support this project.
 - e. Number of Proposed Fire Hydrants: Provide the number of proposed fire hydrants to be added to support this project.
 - f. This sheet will be sent by JCSA to the James City County Fire Department for their approval. The Fire Department approval will be required as a component to the JCSA approval of this Water Data Sheet.
5. Provide the Water Distribution Information as follows:
 - a. Water Distribution Piping: Provide the diameter (inches), length (feet) and pipe materials (DI, PVC, HDPE, etc) for the water distribution system piping for this project. The length of pipe must correspond to the pipe within proposed JCSA easements or pipe within public right-of-ways. If multiple phases or sections of a project are anticipated, include only the piping proposed on the phased site plan.
 - b. Water Meter Assemblies: Provide the size (inches) and the number of each meter size for the water distribution system submitted. Water meter sizing for commercial developments shall be calculated using the International Plumbing Code as adopted and amended by the Uniform Statewide Building Code (latest edition) for fixture counts and flow values and AWWA Manual - M22 for water meter size based on the calculated flow rates. Provide a copy of the water meter sizing calculations with this analysis. Also provide calculations for justification of irrigation meters if a separate irrigation meter is proposed. Detector Check Valve water meters shall be listed individually. If multiple phases or sections of a project are anticipated, include only those water meters proposed on the phased site plan.

- c. The use of multiple meters in lieu of a single, larger meter, is prohibited unless as authorized by the JCSA.
- d. Submit calculations which verify the existing or proposed water service line velocities do not exceed 5 feet per second based on the peak hour demand.
- e. Casing Pipe: Provide the casing pipe diameter (inches) and length (feet).

WATER DATA SHEET

Date: _____ Revised: _____ JCC Case: _____

I. GENERAL INFORMATION:

- a. Project Name: _____
- b. Project Address: _____
- c. Developer: _____
- d. Submitted By: _____
- e. Contact Person: _____
- f. Address: _____

- g. Phone: _____ Fax: _____ Email: _____

II. DESIGN INFORMATION:

- a. Source of Water: _____
- b. Flow Information:

Type of Development	Number of Units	Flow (GPD/Unit)	Flow Duration (Hr)	Total Flow (GPD)
Totals				

Type of Development	Irrigation Demand (gpm)	Average Day Demand (gpm)	Maximum Day Demand (gpm)	Peak Hour Demand (gpm)
Totals				

- c. Hydraulic Analysis: Peak Hour Demand (gpm) + Irrigation Demand (gpm):
_____ @ _____ psi > 40 psi (Node _____)
(Attach a hydraulic analysis that supports the above flow and pressure results)

WATER DATA SHEET (continued)

Date: _____ Revised: _____ JCC Case: _____

Project Name: _____

Project Address: _____

III. FIRE FLOW INFORMATION:

- a. Actual Fire Flow Test Information: *(Attach a copy of fire flow test with this form.)*

Date Performed: _____ Nozzle Size: 2-1/2 inch

Hyd. No. _____ Static _____ psi Residual _____ psi

Hyd. No. _____ Pitot _____ psi Flow _____ gpm

Hyd. No. _____ Pitot _____ psi Flow _____ gpm

Hyd. No. _____ Pitot _____ psi Flow _____ gpm

Total Residual Flow _____ gpm

Calculated Flow @ 20 psi _____ gpm

- b. Fire flow to support this project per JCSA Criteria Section 2.11: _____ gpm @ 20 psi
- c. Fire flow to support this project per JCC Fire Department (provide supporting documentation if different from the JCSA fire flow standards above) _____ gpm @ 20 psi
- d. Hydraulic Analysis: Fire Flow + Maximum Day Demand + any applicable irrigation demands:
_____ gpm @ _____ psi. > 20 psi (Node _____)
(Attach a hydraulic analysis that supports the above flow and pressure results)

- e. Number of Existing fire hydrants: _____

- f. Number of Proposed fire hydrants: _____

NOTE: A maximum single flow from any fire hydrant shall not exceed 1000 gpm.

Fire Department Approval (County use only):

Approved by: _____

Date: _____

WATER DATA SHEET (continued)

IV. WATER DISTRIBUTION INFORMATION:

- a. Water Distribution Piping (Include Fire Hydrant piping, exclude service lines smaller than 4-inch diameter):

Pipe Diameter (Inches)	Pipe Length (Feet)	Material Type (DI, PVC, etc)
Totals		

- b. Water Meter Assemblies:

Water Meter Size (Inches)	Quantity

Note: Water meter sizing for commercial site plans shall be calculated using the International Plumbing Code as adopted and amended by the Uniform Statewide Building Code (latest edition) for fixture counts and flow values and the AWWA Manual – M22 for water meter size based on the calculated flow rates. Meter sizing shall be based on not exceeding 80% meter capacity unless approved otherwise by JCSA. Provide a copy of the water meter sizing calculations with this form. Submit calculations which verify the existing or proposed water service line velocities do not exceed 5 feet per second based on the peak hour demand.

Casing Pipe:

Diameter _____ (Inches), Length _____ (Feet)

Diameter _____ (Inches), Length _____ (Feet)

B. **Sanitary Sewer System Data Sheet:** Provide a completed sanitary sewer data sheet with all sanitary sewer system projects. The Sanitary Sewer System Data Sheet shall be completed as follows:

1. Date: Provide the date the Sanitary Sewer System Data Sheet was completed. If revisions are necessary, add each revision date. Provide the JCC case number.
2. Provide the following information under General Information:
 - a. Provide the project name: The project name must match the name on the JCC Case Application.
 - b. Provide the project address: Provide the address if available or a description of the location of the project.
 - c. Developer: Provide the firm name of the responsible party for the development.
 - d. Submitted By: Provide the name of the firm submitting this project for review.
 - e. Contact Name: Provide the name of the contact person JCSA may contact to address questions concerning the application.
 - f. Address: Provide the address of the contact person.
 - g. Provide the phone and fax numbers and the e-mail address of the contact person for this application.
- a. Provide the following information requested under Design Information as follows:
 - a. Sanitary Sewer System: Provide the name of the collection basin or receiving lift station or pump station such as Lift Station 3-9 (Indigo Dam Road), HRSD Force Main, etc.
 - b. Design Population: Provide the breakdown of the proposed development such as 100-single-family homes and/or 10,000-gross square feet Office Building, etc. This item and flow duration shall reflect the type of development listed in Table 2.1- Flow Demands. Provide the total peak flow in accordance with Section 2.10, paragraphs E and F.
 - c. Sanitary Sewer System Piping: Provide the diameter (inches), length (feet) and pipe materials (DI, PVC, HDPE, etc.) for the sanitary sewer gravity and force main system piping for the development. The length of pipe must correspond to the pipe within proposed JCSA easements or pipe in public right-of-ways. If multiple phases or sections of a project are anticipated, include only the piping proposed on the phased site plan.

- d. Sanitary Sewer Manholes: Provide number of standard manholes, number of 60-inch diameter manholes, and their respective average depths.
- e. Casing Pipe: Provide the casing pipe diameter (inches) and length (feet).

SANITARY SEWER SYSTEM DATA SHEET

Date: _____ Revised: _____ JCC Case: _____

I. GENERAL INFORMATION:

- a. Project Name: _____
- b. Project Address: _____
- c. Developer: _____
- d. Submitted By: _____
- e. Contact Person: _____
- f. Address: _____
- g. Phone: _____ Fax: _____ Email: _____

II. DESIGN INFORMATION:

A. Sanitary Sewer System: _____

B. Design Population: (attach chart if additional space is required)

Type of Development	Number of Units	Flow (GPD/Unit)	Flow Duration (Hr)	Total Average Flow (GPD)	Total Peak Flow (GPM)
Totals					

C. Sanitary Sewer System Piping: (include 6-inch sewer laterals)

Pipe Diameter (Inches)	Piping System (Gravity or Force Main)	Length (Feet)	Material (DI, PVC, etc)

D. Sanitary Sewer Manholes:

Standard Manholes: _____, Average Depth: _____

60-inch Manholes: _____, Average Depth: _____

E. Casing Pipe:

Diameter _____ (inches), Length: _____ (feet)

2.10 **FLOW DEMANDS AND DESIGN CONSIDERATIONS:** Design basis for new developments shall be based on the following flow criteria:

- A. Maximum Day Water Demand - maximum day demand is defined as 1.7 times average day demand.
- B. Peak Hour Water Demand - peak hour demand is defined as 4.0 times average day demand.
- C. Average Day Water Demand - average day demand is defined by Table 2.1 based on the number of units, flow rate and flow duration for each development type for master planning purposes and residential developments. For site specific site projects, the demand shall be calculated based on the International Plumbing Code (IPC) for fixture counts and flow values. The IPC flow value, which is a peaked demand, shall be divided by a factor of 4 for the Average Day Demand.
- D. Water meter sizing for commercial site plans shall be calculated using the International Plumbing Code as adopted and amended by the Uniform Statewide Building Code (latest edition) for fixture counts and flow values and the AWWA Manual – M22 for water meter size based on the calculated flow rates. Meter sizing shall be based on not exceeding 80% meter capacity unless approved otherwise by JCSA. Provide a copy of the water meter sizing calculations with this form. Submit calculations which verify the existing or proposed water service line velocities do not exceed 5 feet per second based on the peak hour demand.
- E. Peak Sewer Flow - lateral and sub-main sewers.
 - 1. Lateral - a sewer that has no other common sewers discharging into it.
 - 2. Sub-main - a sewer that receives flow from one or more lateral sewers.
 - 3. Minimum Peak Design Flow should be 400-percent of the average design flow.
- F. Peak Sewer Flow - main trunk and interceptor sewers.
 - 1. Main or Trunk - a sewer that receives sewage from one of more sub-main sewers.
 - 2. Interceptor - a sewer that receives sewage flow from a number of gravity mains, trunk sewers, sewage force mains, etc.
 - 3. Minimum Peak Design Flow should be 250-percent of the average design flow.
- G. General -In general, sanitary sewer systems should be designed for the estimated ultimate tributary population with an upper limit consisting of the 50-year population growth projection, except when considering parts of the system that can be readily increased in capacity. Consideration shall be given to land use plans and to the other planning

documents and to the maximum anticipated capacity of institutions, industrial parks, apartment development, etc.

H. Sanitary Sewer Design Considerations: All sanitary sewer systems shall be designed with the following considerations:

1. Peak hourly sewage flows
2. Additional maximum sewage or waste flow from industrial plant
3. Ground water infiltration
4. Topography of area
5. Depth of excavation
6. Slope of sewer lines and laterals
7. Pumping requirements
8. Downstream system capacity

Table 2.1

Type of Development	Contributing Design Units	Flow or Demand (GPD/Unit)	Flow or Demand Duration (hours)	Sewer Flow Peaking Factor	Water Flow Peaking Factor
Dwellings	Per Unit	310	24	2.5	(6)
Trailer Courts, Apartments, Condos, Townhomes & Timeshares	Per Unit	310	24	2.5	(6)
Schools	Per Person	10	8	3	(6)
Boarding Schools	Per Person	75	16	3	(6)
Hotels & Motels	Per Room	130	24	3	(6)
Restaurants (including fast food)	Per Seat	30	16	3	(6)
Service Stations	Per Gross SF	0.4	16	3	(6)
Shopping Centers	Per Gross SF	0.2	12	3	(6)
Hospitals	Per Bed	300	24	3	(6)
Nursing Home/Assisted Living	Per Bed	160	24	3	(6)
Doctor's Office in Medical Center	Per Gross SF	0.25	12	3	(6)
Laundromats	Per Machine	500	16	3	(6)
Community Colleges	Per Student and Faculty	10	12	3	(6)
Theaters (auditorium type)	Per seat	2.5	12	3	(6)
Picnic Areas	Per Person	5	12	3	(6)
Camps, Resort day & Night with Limited Plumbing	Per Site	50	24	3	(6)
Luxury Camps With Flush Toilets	Per Site.	100	24	3	(6)

Table 2.1 (Cont'd)

Type of Development	Contributing Design Units	Flow or Demand (GPD/Unit)	Flow or Demand Duration (hours)	Sewer Flow Peaking Factor	Water Flow Peaking Factor
Warehouse	Per Gross SF	0.05	24	3	(6)
Convenience Store	Per Gross SF	0.3	24	3	(6)
Office Building	Per Gross SF	0.1	12	3	(6)
Fitness Center	Per Gross SF	0.1	16	3	(6)
Religious Assembly	Per Seat in Main Assembly Room	2.5	6	3	(6)
Heavy Industrial	Per Gross SF	0.35 ⁽¹⁾	16	3	(6)
Light Industrial	Per Gross SF	0.10 ⁽¹⁾	16	3	(6)

Sanitary Sewer Flow Projection Notes:

- (1) The stated flow per day per unit is provided as a guide and should only be used if known data for similar heavy or light industrial facilities is not available.
- (2) For undeveloped property zoned other than residential, average daily flows may be projected at a rate of 1,000 gpd per acre. Consideration should be given to designated wetlands and Chesapeake Bay Preservation Act Resource Protection Areas (CBPA RPA) which should be excluded from the gross acreage. A peaking factor of 3 shall be used.
- (3) For undeveloped property zoned residential, average daily flows may be projected at a rate of 310 gpd per unit based on the zoning density. A peaking factor of 2.5 shall be used.
- (4) Flow duration should be taken into account for design of onsite infrastructure and when discharging into Publically owned force mains, but need not be considered for downstream publically owned gravity collection systems. Additionally, the SCAT Regulations require a peaking factor of 4 be applied to the average daily flow when designing laterals and sub-mains. For example, in designing an on-site sanitary sewer lateral or an on-site private pump station for a shopping center that has a gross square footage of 7,500 SF, the flow duration should be applied as follows:

$$\begin{aligned}
 7,500 \text{ SF} \times 0.20 \text{ gpd/SF} &= 1,500 \text{ gpd} \\
 1,500 \text{ gpd} / (12 \text{ hour duration} \times 60 \text{ min/hr}) &= 2.08 \text{ gpm} \\
 2.08 \text{ gpm} \times 4 \text{ (peak factor per SCAT regulations)} &= 8.32 \text{ gpm}
 \end{aligned}$$

- (5) Sound engineering judgment must be used in all application of these flow projection guidelines.

Table 2.1 (Cont'd)

- (6) Water Demand Peaking Factors shall be as defined in Section 2.10 for Average Day, Maximum Day (1.7 x Average Day) and Peak hour Demands (4 x Average Day).
- (7) For all undeveloped property, water demands shall be based on the number of residential units and/or commercial square footage anticipated for the development either by current zoning or where limited by Proffers. Peaking factors shall be as defined in Section 2.10.

- 2.11 **FIRE FLOW REQUIREMENTS:** Fire flow demands are specified by the James City County Fire Department and are based on the designated zoning, use, and specific type of construction. The zoning categories are:

- A. Residential: To include, but not limited to, Single-family, Manufactured Homes, Apartments, Townhouses, Condominiums, Motels, etc.
- B. Commercial: To include, but not limited to, Offices, Small Businesses, Hotels, Shopping Centers, Food Markets, Small Buildings, Churches, etc.
- C. Industrial: To include, but not limited to, Plants, Factories, Larger Buildings, Industrial Facilities, etc.

The fire demand ranges from 1,000 gpm to 4,500 gpm. The following table shows the guidelines for specified fire demands based on project type. In the JCSA distribution network, the maximum flow allowed for a single fire hydrant is 1,000 gpm. If the project has a required demand greater than 1,000 gpm, then additional hydrants must be included for the project to meet the specified demand. Each project's fire flow requirements shall be specified by the Fire Chief for the James City County Fire Department. Available fire flows for existing fire hydrants shall be verified by a fire hydrant flow test performed by JCSA and/or the James City County Fire Department.

FIRE FLOW DEMANDS

Single-family	1,000 gpm
Apartments/Townhouses/Condominiums	2,500 gpm
Motels/Hotels/High Rise Apartments	2,500 gpm
Commercial Light	2,500 gpm
Heavy	3,500 gpm
Industrial Light	3,000 gpm
Heavy	4,500 gpm

- 2.12 **THRUST RESTRAINTS:** Thrust restraints shall be provided at all pipe fittings, bends, tees, and valves. Thrust restraints shall consist of retainer glands. Manufactured joint restraints may be used, where appropriate, in place of retainer glands.

Manufactured joint restraints shall be supplied by the same manufacturer as the pipe material and shall be subjected to the same submittal and compliance requirements as the approved pipe. The minimum restrained lengths shall be in accordance with JCSA standard detail JR.1. Fire hydrant assemblies shall be restrained at least one full joint of pipe in each direction on the mainline.

2.13 **CONNECTION TO EXISTING WATER AND SANITARY SEWER SYSTEMS:**

All connections to existing water systems to include saddles, service lines, tapping sleeves and valves and direct taps, and connections to existing sanitary sewer systems to include saddles, laterals, manhole connections, force main connections, etc., shall be scheduled with JCSA. **The connections shall be made only in the presence of JCSA.** Connections to existing manholes shall be made by core-drilling the manhole and connecting the pipe using a KOR-N-SEAL boot, or equal. Existing manholes shall be vacuum tested upon completion of the new connection. Connections to sewer laterals shall be made to the wye, and not to the stand pipe, if the wye is five (5) feet or less from the ground surface. When the wye is deeper than five (5) feet, the lateral may be tied into the stand pipe, at a minimum depth of depth of cover of three (3) feet.

Fernco couplings, or similar products, shall not be permitted on JCSA water mains, sanitary sewer mains, force mains, laterals or standpipes.

All water service connections shall be metered. Private water and sanitary sewer services and plumbing shall conform to the Uniform Statewide Building Code (latest edition.)

2.14 **MINIMUM GRADES:** Sanitary sewers shall have a uniform slope and straight alignment between manholes (unless approved otherwise by JCSA), and be designed and constructed to achieve total containment. Minimum grades shall not be less than those required to produce a velocity of approximately two (2) feet per second when the size pipe selected is flowing full and using an “n” value of 0.013 in the Manning Equation. Minimum grades shall be as follows:

Sewer Size (inches)	Minimum Slope (Feet per 100 Feet)
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24	0.08
27	0.067
30	0.058
36	0.046

- 2.15 **MAXIMUM VELOCITY**: Generally, the maximum permissible velocity in gravity sewers shall not exceed fifteen (15) feet per second. Where velocities greater than fifteen (15) feet per second are expected, special provisions shall be made to protect against internal erosion by high velocity. The pipe shall conform to appropriate ASTM or AWWA specifications which provide protection against internal erosion. Drop manholes shall be provided to break steep slopes to limit the velocities in connecting sewer pipes between manholes. Where drop manholes are impractical, the sewer main shall be ductile iron or other abrasion resistant material. Sanitary sewer on 20% slope or greater shall be anchored with concrete anchors in accordance with JCSA standard detail S16.0 and Section 21.05.03 of the Commonwealth of Virginia SEWERAGE REGULATIONS. Suggested minimum anchorage is as follows:
- A. Not over 36-feet center to center on grades 20 percent and up to 30 percent.
 - B. Not over 24-feet center to center on grades 30 percent and up to 50 percent.
 - C. Not over 16-feet center to center on grades 50 percent and over.
- 2.16 **JUNCTIONS**: At all junctions where a smaller sewer joins a larger one, the invert of the larger sewer shall be lowered to maintain the same energy gradient. This may be accomplished by one of the following methods:
- A. Positioning the 0.8 depth point of both sewers at the same elevation, or
 - B. Positioning the crown of both sewers at the same elevation.
- 2.17 **MANHOLES**: Manholes shall be designed to include the following:
- A. Manholes shall be installed at the end of each line of eight (8) inch diameter or greater; at all changes in grade, size, or alignment; at all intersections; and at distances not greater than 400-feet.
 - B. Manholes for sewers up to 24-inches in diameter shall not be less than 48-inch inside diameter.
 - C. Manholes for sewers larger than 24-inches in diameter shall not be less than 60-inch inside diameter.
 - D. Manhole top elevations shall be above the 100-year Flood Elevation or shall be sealed watertight frame and cover with approved casting or inserts. Ventilation of gravity sewer systems shall be provided where continuous watertight sections greater than 1,000-feet in length are incurred.
 - E. Stubs out of manholes for future development shall not exceed 2-feet in length, unless approved otherwise by JCSA.

- F. Minimum elevation difference across manhole from inlet to outlet shall be 0.1 feet.
- G. Epoxy manhole coatings shall be provided where lift station force mains or low pressure lines with five (5) or more residential grinder pumps connect to a manhole. A minimum of three (3) manholes and 1200 feet downstream of these force main connections shall be coated. Plans shall clearly designate the manholes requiring coating, the coating manufacturer and minimum Type A coating as defined in the HRPDC standards. JCSA reserves the right to require additional manholes for epoxy coating where deemed necessary.
- H. Sanitary Sewer laterals shall not connect to the mainline within 5-feet of a manhole. Laterals upstream and within 5-feet of the manhole shall connect directly into the manhole where necessary.
- I. Interior drop connections shall be constructed when the vertical difference between the invert of the outlet pipe and the invert of the inlet pipe is 24-inches or greater. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24-inches, the invert shall be filleted to prevent solids deposition.

2.18 **MINIMUM SIZES:** No public sanitary sewer shall be less than 8-inches in diameter, except collector lines serving six (6) connections or fewer on cul-de-sacs. Additionally sidewalk collector lines may be 6-inches in diameter provided that engineering calculations and justifications indicate that such size is adequate, and the collector line terminates with a manhole. The minimum size for a single lateral connection is 4-inches inside diameter. JCSA reserves the right to specify the size of any sanitary sewer main or lateral.

2.19 **DEPTH OF SEWERS:** All sewers shall be constructed in such a manner that a minimum of 3-feet of cover is maintained between the top of the pipe and the finished grade elevation. Where conditions dictate that the cover be less than 3-feet, ductile iron pipe will be required, and the installation shall be approved by the JCSA. For depths of sewer exceeding 12-feet, ductile iron pipe shall be used. For depths of sewer exceeding 25-feet, manhole design and calculations (sealed by a registered professional engineer in the Commonwealth of Virginia), and certification from the ductile iron pipe manufacturer indicating that the pipe is capable of sustaining the proposed loads, shall be required.

2.20 **SURFACE WATER CROSSING:** Surface water crossings, both over and under water, present special problems and should be discussed with JCSA and the Department of Environmental Quality prior to final plan preparation. Water and sanitary sewer mains passing over surface water shall be adequately supported, protected from damage due to freezing, accessible for repair or replacement, and located above the 100 year flood level. Water and sanitary sewer mains passing under surface water shall be of a special type of construction utilizing flexible watertight joints. Also, for pressure pipelines, valves and sample taps shall be located at both ends of the surface water crossing for testing and repairs. The valves shall be easily accessible and not subject to flooding. Sample taps shall also be available at a reasonable distance from each side of the crossing. All surface water crossings shall be approved by the Department of Environmental Quality prior to construction.

- 2.21 **PIPE CROSSING SEPARATION**: Pipe separation at crossings between water, sanitary sewer, storm, gas, or other pipe systems shall be 18-inches unless approved by JCSA. Where JCSA allows less than 18-inches separation, the pipe crossing shall comply with JCSA standard detail PC.1. Reference the HRPDC Regional Construction Standards, Section 805, for additional requirements regarding separation of water mains and sewers.
- 2.22 **PROXIMITY TO BEST MANAGEMENT PRACTICES (BMP'S)**: Unless authorized by JCSA, water and sanitary sewer mains, appurtenances and easements shall not be placed within a BMP, stormwater structure, or associated embankment. BMP's or stormwater structures shall not be constructed within existing water or sanitary sewer easements.
- 2.23 **PLAN CLARITY**: Water and sanitary sewer force main appurtenances such as valves, fittings, air release valves, etc., shall be shown in both plan and profile views. Plan of development shall be clear and concise. It is necessary to call the appurtenances out in only one location, with stationing and offset annotated, as long as they are depicted graphically in both. Water and sanitary sewer pipe material (PVC or DIP) shall be clearly identified on the plan and/or profile. Plan and profiles shall be developed at a minimum scale of 1"=50' horizontal and 1"=5' vertical. Plan and profile horizontal scales shall be the same with the vertical profile scale a tenth of the horizontal scale.

Plan revisions and/or slip-sheeting during the site plan submittal process shall be properly described in the border revision block with date of revision. Any plan revisions made after site plan approval shall also include "clouding" the revision for clarity.

JCSA and/or HRPDC references to the applicable standard details (i.e. Typical Water Meter Installation, W13.0) shall be provided on the plan, either individually labeled or tabularized. Standard details shall not be provided on the plan unless modified. If modified, the engineer shall clearly identify those modifications on the detail.

- 2.24 **GREASE TRAPS**: Grease traps are required for all restaurants or other commercial establishments expected to discharge FOG (fats, oils, and grease) to the wastewater collection system. Grease trap design shall comply with the International Plumbing Code (current edition adopted by the James City County Codes Compliance Department). Provide a tee with a 4-inch vertical standpipe and a cast iron clean-out frame and cover to be used as a sampling station for the proposed grease traps. This sampling station should be located within 5-feet from the grease trap on the effluent side.
- 2.25 **GRINDER PUMPS**: JCSA Grinder Pump Policies and Procedures shall be followed. When grinder pump lots are designated on development plans, flow and head conditions anticipated for the particular lot shall be recorded on the Plat. Refer to Detail GP-1 thru GP-3.1.
- 2.26 **GENERAL SYSTEM DESIGN CONSIDERATIONS**:
- A. Buried ductile iron pipe and fittings shall have mechanical or push-on joints. Above ground ductile iron pipe and fittings shall have flange joints or restrained joint mechanical

joints as appropriate and approved by JCSA. For flange piping, use of multi-gaskets and spacers are prohibited.

- B. Where PVC pipe less than 4-inches in diameter is specified to be used in Right-Of-Ways and where subjected to surface (vehicular) loads, schedule 80 pipe shall be required. On water service lines, PVC schedule 80 pipe may only be used in lieu of copper pipe where the installation exceeds 80-linear feet.
- C. Valves shall be installed on all temporary dead-end pressure pipelines, on small branching mains as close as possible to the larger main, and on loop networks. Valves shall also be placed on water mains so that a break or failure will not affect more than 800-linear feet of main. Valves shall be located at the tee for all intersecting water mains and sanitary sewer force mains. Provide at intersecting mains one valve per the number of connecting waterlines (i.e. provide four (4) valves for an intersecting cross fitting).
- D. Air release valve assemblies shall be constructed at all high points along pressure pipelines. Where practical, high points shall be eliminated by slight adjustments to the pressure pipeline profile. Locations of manual air release valves shall be shown on the construction plan and profile drawings.
- E. Blow-off assemblies shall be constructed at all dead end points along the water mains. Locations for the Blow-off assemblies shall be shown on the construction plan and profile drawings.
- F. Fire Hydrant Locations: Fire hydrants shall be installed in the public right-of-way or in a JCSA easement. Fire hydrants shall be located in non-traffic areas (i.e., in an island or behind a curb). Fire hydrants shall be installed at an intersection whenever possible. Fire hydrants installed at an intersection shall be located at the curb's point of curvature. All other fire hydrants shall be located in-line with a property line perpendicular to the right-of-way line, whenever possible. In Townhouses, Condominiums, Apartments, Commercial and Industrial areas, fire hydrants shall be located in a raised island (grass or concrete) when not at an intersection. Each fire hydrant location shall be approved by JCSA and the James City County Fire Department. In addition, fire hydrants shall be located on the following:
 - 1. On highways divided by a median strip, hydrants shall be located on each side of the right-of-way as per the fire hydrant spacing requirements.
 - 2. On cul-de-sacs the distance between the last fire hydrant and the end of the cul-de-sac shall not be more than one-half ($\frac{1}{2}$) distance specified in the fire hydrant spacing.
 - 3. JCSA, in consultation with the Fire Chief, may require that additional fire hydrants be provided on the site at specified locations in order to ensure adequate fire suppression capabilities and to allow the system to be flushed periodically of accumulated sediments.
 - 4. For developments that are served by independent water production facilities, the water

source and facilities shall be constructed to provide adequate fire protection.

- G. Fire Hydrant Spacing Requirements: Fire hydrant spacing is specified by the James City County Fire Department. The hydrant spacing ranges from 400-feet for commercial/industrial areas to 800-feet for single-family residential areas.
- H. Sanitary sewer cleanouts shall not be installed in driveways, sidewalks, or bike paths except when approved by JCSA, and will require the frame and cover for heavy loads (HRPDC Regional Construction Standards Detail SS_12). The Engineer shall evaluate this requirement where subdivision Lots and/or sites have minimal roadway frontage and cleanout locations will be likely located within driveways, whether or not shown on the plan. In this instance, SS_12 cleanouts shall be clearly specified on the plan. JCSA reserves the right to require SS_12 cleanouts be provided at its direction.

- 2.27 **WATER METER:** Water meters shall be Neptune model T-10, Tru/Flo Compound, or Protectus III Fire Service meters as manufactured by the Schlumberger Water Division, or as approved by JCSA, and shall register in gallons. Water meters 2-inches and smaller shall be paid for by the Builder or Developer with purchasing and installation by JCSA. Water meters larger than 2-inches shall be purchased and installed by the Builder or Developer with installation witnessed by JCSA. Meter type/model shall be approved by JCSA prior to Builder or Developer purchasing the water meter. Water meter type and model shall be indicated for all 2-inch and larger water meters. All 2-inch and larger meters shall be compound type unless otherwise approved by JCSA

AMR Meters shall be PRO-Read encoder style with large style remote touch pads. Touch pad shall be installed in accordance with manufactures recommendation in a location acceptable to JCSA. The pad location must provide access for wand style readers, is protected from external damage, does not require the opening of any hatches or lids in order to be read and is easily maintained. All hardware for attaching pads must be stainless steel and easily removable.

Parameters for designing/installing water meters and service connections shall involve the following:

1. Water meter box installation shall maintain a minimum 18-inch horizontal edge-to-edge clearance from driveways and/or drive paths, sidewalks or bike paths, unless approved otherwise by JCSA.
2. Water meter relocations shall require a new tap when landscaping or other physical features require relocation of the existing service more than 5-feet.
3. Water service lines shall be perpendicular to the main, except in cul-de-sacs.

- 2.28 **DETECTOR CHECK VALVE:** A detector check valve with a backflow prevention device located downstream is required at the following locations:

- A. Master meters for entire water systems (Neptune Protectus III).
- B. Fire services or automatic sprinkler services.
- C. Locations of backflow prevention devices shall be approved and inspected by JCSA.

Detector check valve shall be Ames model 1000 SS DCV. The detector assembly shall be installed in accordance with JCSA detail W17.0; the detector meter shall be 5/8-inch x 3/4-inch.

2.29 **BACKFLOW PREVENTION DEVICES:** Backflow prevention devices shall be installed as required by JCSA's Backflow Prevention and Cross Connection Control Program. The installer's responsibility is to make proper installation of approved backflow prevention devices, in accordance with the manufacturer's installation instructions, the Uniform Statewide Building Code, and any additional instructions offered by JCSA. Approved backflow prevention devices and assemblies are those that meet AWWA standards, and are approved by ASSE and the USC-FCCC (University of Southern California Foundation for Cross Connection Control and Hydraulic Research). Flow orientation, access, and installation of backflow preventers shall be provided in accordance with USC-FCCC guidelines and as specified by the installation instructions of the approved manufacturer. NOTE: USC approval is specific to orientation, horizontal or vertical, device model number and size. Approvals are continuously verified and can be rescinded. Thermal expansion and/or water hammer downstream of the assembly can cause excessive pressure. To avoid possible damage to the system and assembly, the installer will use water hammer arresters, surge protectors, relief valves and expansion tanks as appropriate. Only testable devices that meet or exceed current and future hazards to the JCSA's distribution system shall be approved and accepted by the JCSA Engineering Division or the JCSA Cross Connection Control Coordinator. Approved method or type of construction shall be included. Backflow prevention assemblies must not be installed in locations subject to flooding such as underground vaults. Protection of backflow preventers shall meet current code requirements and outdoor enclosures for backflow preventers shall comply with ASSE 1060. Refer to JCSA's Backflow Prevention and Cross Connection Control Program Weblink at <http://www.jccegov.com/jcsa/index.html> for further information.

2.30 **CONTROL VALVES (2 inches in Diameter and Larger):** Control valves (2" and larger) shall be hydraulically operated, pilot-controlled diaphragm-type globe valve. All control valves shall be constructed in an above ground structure meeting the requirements of JCSA. The main valve shall have a single removable seat and a resilient disc. The stem shall be guided at both ends by a bearing in the valve core and an integral bearing in the valve seat. No external packing glands are permitted and there shall be no pistons operating the main valve or any pilot controls. The pilot control shall be a direct-acting, adjustable, spring loaded, normal open, diaphragm valve, designed to permit flow when controlled pressure is less than spring setting. The control valve shall be class 125 bronze fittings manufactured in accordance with ANSI B16.1, ASTM A48, B61, and B62, adjustable from 30 to 300 psi. Valves shall have an internal and external epoxy coating in accordance with AWWA C550-latest revision. Valves shall be furnished with a Delrin stem in both normally open and normally closed configurations. Valves shall also include position indicator devices. Valves

shall have remote control and SCADA (Supervisory Control and Data Acquisition) features as required by JCSA. This valve shall be Cla-Val or approved equal. Control valve functions include one or more of the following:

- A. **Check Valve:** Check valves shall be no-slam operation, drip tight shut off and shall have adjustable dual speed controls.
- B. **Pressure Reducing:** Pressure reducing valves shall provide sensitive and accurate pressure control, shall provide easy adjustment and maintenance, shall be tamper resistant, and shall include a fully supported frictionless diaphragm.
- C. **Combination Pressure Reducing and Pressure Sustaining Valves:** Combination pressure reducing and pressure sustaining valves shall have accurate response to slight pressure changes, a check feature, shall be completely automatic operation, drip tight, positive seating; and, shall have fully hydraulic operation
- D. **Solenoid Actuated Valve:** Solenoid actuated valve shall have quick acting solenoid actuation, and shall provide for ease for installation and maintenance.
- E. **Rate of Flow Control Valves:** Rate of flow control valves shall accurately limit flow rate, shall have automatic operation, shall include orifice plate and holder, and shall have a check valve feature and allow for ease of adjustment.
- F. **Altitude Valve:** Altitude valves shall include accurate repeatable level control, drip tight positive shut-off, reliable hydraulic operation, easy adjustable controls, complete automatic operation, and shall be either double acting or single flow as required by JCSA.

2.31 **PROCEDURES WHEN CUTTING INTO OR REPAIRING WATER MAINS:** When an existing main is opened, either by accident or design, the excavation will likely be wet and may be contaminated from nearby sewers. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from such contamination. Tablets are preferred because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.

- A. Once the trench has been dewatered and repairs begin, all pipe, couplings, sleeves, and associated appurtenances shall be swabbed or sprayed with a five percent hypochlorite solution before they are installed. No. 57 stone should be applied to the bottom of the open trench to provide adequate footing for repair crews. Upon completion of repairs, flushing from hydrants or other means shall take place toward the work location from both directions if possible. Flushing shall take place immediately after repairs are completed and continue until all discolored water and air is eliminated.
 - 1. Where practical, in addition to the procedures above, a section of main in which the break can be isolated without interrupting service to customers, the section shall be flushed with a 300 mg/L chlorine solution with a contact time of 15 minutes. This shall be accomplished by placing hypochlorite granules into the upstream end of where the repair is taking place.

After the repair is completed, the upstream valve shall be opened only long enough to fill the main. Once the 15 minute contact time has taken place, the main shall be thoroughly flushed until all discolored water and air is removed and the chlorine residual is less than 2 mg/L. Flushing shall take place in such a way as to prevent discolored and heavily chlorinated water from being pushed out into the system.

2.32 **CONSTRUCTING WATER AND SANITARY SEWER PIPELINES IN FILL AREAS:**

When water and sanitary sewer pipelines are proposed to be constructed in fill areas, the design engineer shall include on the plans special construction notes and/or details that will address suitability of fill material and compaction requirements to ensure no settlement below or above the utility lines and sanitary sewer manhole structures. Compaction tests shall be performed by a qualified testing agency at 100-foot intervals along the pipeline alignment (a minimum of two test locations per fill area) at no more than 5-foot vertical intervals. Compact each layer of backfill material to 95% maximum density in accordance with VTM-1 from existing grade to minimum 1-foot above the JCSA utility. Test results, certified by a registered professional engineer licensed in the Commonwealth of Virginia, shall be forwarded to the JCSA prior to final acceptance.

The water or sanitary force main pipe lines installed in fill areas shall be restrained joint ductile iron pipe extending at least 40-feet on either side of the fill into native ground. Gravity sanitary sewer lines installed in fill areas shall be restrained joint ductile iron pipe extending to the nearest manholes on either end of the fill which are located in native ground.

2.33 **SUBSURFACE UTILITY LOCATING:** Test holes shall be performed and information incorporated in the design for all existing pipe crossings where conflicts with proposed utilities may occur. This shall include physically locating all proposed connections to existing JCSA water and sanitary force main systems. As part of the site plan process, the developer/engineer shall provide test hole data sheets to JCSA which substantiate the horizontal and vertical location of each crossing/connection.

2.34 **TEMPORARY CONSTRUCTION METERS:** Temporary construction meters shall be installed in accordance with JCSA detail W23.0.

2.35 **MASTER UTILITY PLAN DEVELOPMENT:** Where required by JCSA, Master Utility Plans with associated hydraulic modeling and calculations shall be submitted prior to site plan submittal. Generally, Master Utility Plans shall be submitted for large scale developments, projects being developed in phases, and developments requiring multiple water and or sewer pump station facilities. JCSA general guidelines for development of Master Utility Plans are included in Appendix E.

2.36 **GEOTHERMAL WELLS:** All proposed geothermal wells shall be shown on a site plan. The site plan shall be reviewed and approved by the James City Service Authority.

1. The site plan shall contain the following:

- a. Wells shall be issued the appropriate State Health Department and James City County permits prior to construction.

- b. A James City County (JCC) certified well driller shall be employed to drill all wells.
 - c. Geothermal wells shall not be located within the limits of a stormwater management facility or other areas subject to frequent surface water intrusion.
 - d. Well construction shall conform to the State Health Department, waterworks regulations and private well regulations.
 - e. Drilling fluid mix water shall be from a potable water source. Drilling fluids shall be sodium bentonite clay.
 - f. Reinjection of water or any other substances back into the groundwater system for heat pumps or any reason shall be prohibited.
 - g. Provide a typical Geothermal well detail on the plans including:
 - i. Diameter of the wells
 - ii. Depth of wells
 - iii. Full depth grout
 - iv. Closed loop system
 - v. Number of wells
 - vi. Location of wells and well field
2. Proposed Geothermal Wells, within 1500 feet radius of a public water well or if determined by JCSEA to be a potential influence to a public well, shall also provide the following:
- a. The Applicant must confirm that the Chickahominy-Piney Point aquifer is below the bottom of the proposed depth of the geothermal well, or is non-existent in the vicinity of the proposed geothermal well field.
 - b. The only fluids allowed in the piping/well system shall be potable water and food grade antifreeze additives.
 - c. Provide methods of constructing the geothermal wells including mud pits and measures to control drilling fluids/mud.
 - d. Contact information of the person responsible for inspecting the full depth grout installation. The person shall provide to JCSEA a Certification Letter that states they witnessed and can certify all wells were inspected during the grouting process. The certifying person shall have one of the following qualifications:
 - i. Professional Engineer licensed in Virginia
 - ii. Certified Professional Geologist
 - iii. Third party JCC certified well driller

- e. Grout shall be pumped through the tremie pipe until grout appears at the surface. Grout shall be placed in one continuous operation.
- f. Well grouting shall be completed prior to removal of the drill rig.